SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION

This manual provides service information for the Videocorder decks used in the following SONY Videocorder Models : CV-2100, TCV-2110, and CV-2200. Camera and Monitor service information is found in separate Service Manuals.

1-2. SPECIFICATIONS

Video recording system:	Rotary two-head slant-track scanning.
Recording Signal:	2:1 interlaced composite video signal based on American TV standards using EIA or industrial sync.
Recording time:	60 minutes (continuous) using V-32 tape.
	30 minutes (continuous) using V-31 tape.
Tape Width:	½ inch.
Tape speed:	7.5 inches per second.
Video modulation System:	Frequency Modulation.
Resolution:	Greater than 220 lines.
Video signal-to-noise ratio:	Greater than 40 db.
Video input:	1.4 to 3 volts (p–p), 75 ohms, sync negative.
Camera video input:	For SONY CVC-2000 and CVC 2100A ONLY, 1.4 volts (p–p), sync negative.
Video output:	1.4 volts (p-p), 75 ohms, sync negative.
Audio inputs:	
microphone–	−65 db, 200 − 600 ohms, unbalanced, manual and AGC.
audio auxiliary input–	−20 db, high impedance, balanced.
Audio line output:	0 db, high impedance, unbalanced.
Audio frequency range:	80–10,000 cps.
Audio signal-to-noise ratio:	Greater than 40 db.
Power requirements:	115 to 120 volts AC, 60 Hz ±0.4 Hz.
Power consumption:	80 watts.

1-3. CONTROLS AND INDICATORS

A. RECORD BUTTON When depressed, it connects the AC power line to the line-input circuits of the Videocorder, and TV or Camera video signals pass through the entire video system and appear at the video output terminals. Thus, the monitor displays signal that have been processed by the electronic systems of the Videocorder. Similarly, input audio signals are processed by the audio circuits and are fed to the monitor. This mode of operation, whereby the monitor displays picture and sound that are fed to the input circuits of the Videocorder for recording purposes, is called "E-to-E" operation. Actual recordings begin when the RECORD button is held down and the FUNCTION LEVER is set to the PLAY position A cam-operated switch, controlled by the FUNCTION LEVER, then applies power to the record (head-driver) amplifiers and the audio bias/erase oscillator.

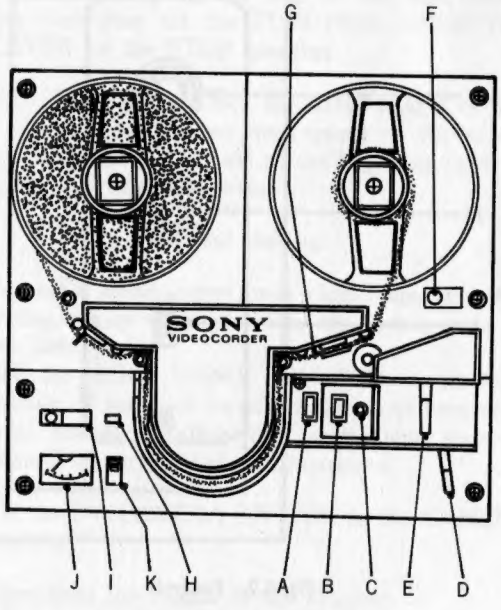

Fig. 1-1. Controls and indicators.

B. SOUND DUBBING BUTTON. The EDITING button and then SOUND DUB buttons are depressed in order to add sound (audio signals) to a prerecorded video signal. Video sections operate in the playback mode; audio sections operate in the record mode.

C. EDIT BUTTON Depress EDIT button and then RECORD button while machine is in playback mode to add new camera/microphone recordings.

D. FAST FORWARD LEVER
FAST FORWARD lever permits the tape to be advanced rapidly. When the lever is actuated, drive is applied directly to the Take-up Reel and the Pinch Roller is pulled back from the Capstan.

E. FUNCTION SELECTOR LEVER
FUNCTION LEVER selects the PLAY, STOP, and REWIND operations of the tape transport mechanism. Basic functions are as follows.

STOP: Supply and Take-up Reels are braked. Pinch Roller is released. Drive is disconnected from both reel tables.

PLAY: Cam Switch supplies A-C input power. Pinch Roller presses against capstan to feed tape. Take-up Reel is driven through a friction-clutch. Cam-operated switch supplies power to the bias/erase oscillator and record amplifier through the RECORD switch.

REWIND: Friction drive as applied to the Supply Reel. Pinch Roller is released from the Capstan and braking is removed from the Take-up Reel.

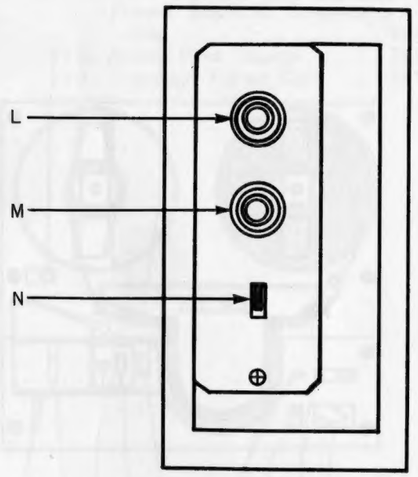

Fig. 1-2. Controls

F. TV/CAMERA SWITCH
TV/CAMERA Switch selects audio and video signals from one of two sources, the SONY CVC-2100 and camera, or the off-the-air TV signals supplied by the monitor.

G. AUTOMATIC SHUT OFF SWITCH
AUTOMATIC SHUT OFF switch senses the presence of tape in the normal tape path, and shuts off the A-C input power if tape runs out or breaks when the Function Lever is in the PLAY or REWIND positions. This automatic feature is disabled when the Function Lever is in the STOP position.

H. AGC LIGHT
AGC Lamp lights only recording when AGC/MANU switch in the AGC position.

I. TAPE COUNTER
TAPE COUNTER provides an indication of the revolutions made by the Take-up Reel. The readout serves as a reference to locate selected recordings on the tape.

J. LEVEL METER
Meter provides a measurement of the video or audio signal levels in the video and audio output stages during record and playback operations.

K. LEVEL METER SELECTOR VIDEO/AUDIO
METER SELECTOR switch sets up the meter to monitor video output or audio output when AGC/MANU switch is set to MANU. Adjust the VIDEO LEVEL CONTROL/STANDBY KNOB so that the needle of the METER SELECTOR falls within the blue region. Adjust the AUDIO LEVEL so that the needle of the does not swing post the blue region during sound peaks.

L. VIDEO LEVEL/STANDBY KNOB
Used for video level adjustments when the AGC MANU switch is set to the MANU (manual) position. Also, pull this knob straight out to start the motor when performing the slip-ring cleaning operation.

M. AUDIO LEVEL CONTROL KNOB
AUDIO LEVEL knob controls the preamplifier audio signal level during E-to-E and record operations when AGC/MANU SWITCH is in the MANU position.

N. AGC/MANU SWITCH
This switch selects automatic or manual control of the recording signal level.

1-4. OPERATING INSTRUCTIONS

This section describes operating modes and control functions. To prepare the VTR for operation, refer to Sections 1–6 (for external equipment connections) and 2–1 (for tape-threading instructions).

Preliminary Setup

1. Thread the tape.
2. Set the TAPE COUNTER to 000 by pressing the reset button positioned at the left of the counter.

Record Mode

1. To put the VTR in the record mode, press the red RECORD button down until it locks in the "down" position. The red jewel on the meter scale will light, indicating that the machine is in the record mode.
2. The monitor will display the signal supplied to the VTR for recording purposes. If the TV/CAMERA switch is in the TV position, the monitor will display the TV signal supplied by the "master" monitor. If the TV/CAMERA switch is in the CAMERA position, the monitor will display the video supplied by the camera. Under these conditions, the VTR is said to be in the E-to-E mode of operation. That is, signals supplied by the signal source (TV or camera) are processed by the circuits of the VTR and are sent back to the monitor for monitoring purposes. In effect, the entire system is operational except for the system link provided by the tape itself. Note, the SONY CVM-51UW/UWP provides an E-to-E indication; the CVM-2300U does not.
3. **Set the AGC/MANU switch to AGC for automatic level control. If manual control is desired, set the switch to MANU and proceed as follows.**
   a. Set the METER SELECTOR switch to VIDEO. Adjust the VIDEO LEVEL control to obtain a reading in the blue zone. Do not set VIDEO LEVEL using extremely dark scenes. Switch channels to obtain a picture with average grays, whites and blacks.
   b. Set the METER SELECTOR switch to AUDIO. Adjust the AUDIO LEVEL control to produce readings that do not swing past the right edge of the blue zone on loud peaks.
4. To start the recording, hold the RECORD button down while moving the FUNCTION LEVER to the PLAY position. This locks the RECORD button down in the record position.
5. To stop the recording, move the FUNCTION LEVER to the STOP position. The RECORD button is released by this action and the VTR reverts automatically to the playback mode.

Playback Mode

1. The VTR operates in the playback mode as long as the red RECORD button is not in the down position.
2. Move the FUNCTION LEVER to the PLAY position. The monitor will display the signal previously recorded on the tape.
3. Video and audio output levels can be checked during playback by setting the METER SELECTOR switch to the appropriate positions. A reading in the blue zone indicates standard output (1.4 V p-p video and 0 dB audio).
4. To skip over a portion of the tape, move the FAST FORWARD lever to the left as far as it will go, and release it. The tape will advance rapidly. To resume normal playback, set the FUNCTION LEVER to STOP and then to PLAY. Tape will move again at the normal playing speed.
5. To stop the playback operation, set the FUNCTION LEVER to the STOP position.

Editing.

1. Complete the connections between the Video Camera and the Videocorder. Set the TV/CAMERA SWITCH to the CAMERA position.
2. Play the prerecorded tape on the Videocorder by setting the FUNCTION SELECTOR LEVER to the PLAY position.
3. When the part where new pictures are to be added is reached, press the EDIT button. Then press the red RECORD button. The new recording from the Video Camera starts when the RECORD button is locked into place. (The EDIT button will come up when the RECORD button is locked.)
4. When you finish editing, set the FUNCTION SELECTOR LEVER to the STOP position.
   To insert new recording between prerecorded pictures and sound, press the EDIT button again 1-2 seconds before the end of the new recording and then set the FUNCTION SELECTOR LEVER to the STOP position.

NOTE: When playing back the edited tape, it is normal that stripes may appear on the screen for about 1 second at the beginning (and the end) of the insertion.

Sound Dubbing.

1. Connect a sound source (microphone, tape recorder, phonograph or radio, etc.) to the proper input of the Videocorder.
   Set the AGC / MANU SWITCH to the AGC position. If you want to adjust the sound recording level manually, follow the instructions given in Manual Recording Level Adjustments'.
2. Set the TV/CAMERA SWITCH to the CAMERA position.
3. Turn down the volume of the Monitor.
4. Play back a prerecorded tape on the Videocorder by setting the FUNCTION SELECTOR LEVER to the PLAY position.
5. When the desired portion for dubbing sound is reached, press the EDIT button. Then, press the SOUND DUB BUTTON. Sound dubbing

starts when the SOUND DUB button is locked into place. (The EDIT button will come up when the SOUND DUB button is locked.)

6. When you finish sound dubbing, set the FUNCTION SELECTOR LEVER to the STOP position.

1-5. OPERATIONAL PRECAUTIONS

1. To prevent accidental damage or needless wear on the video heads, observe the following.
   a. Do not operate the motor unless tape is threaded properly on the machine.
   b. Never attempt to thread the tape while the motor is running.
   c. Avoid leaving the motor running for extended periods while the tape is stationary.
   d. Do not operate the Function Lever if the tape is slack anywhere in the tape path.
2. To prevent erasure of pre-recorded tapes, remember do not put the VTR in the record mode while the prerecorded tape is on the machine. Tape erasure takes place when the RECORD button is down *and* the FUNCTION LEVER is in the PLAY position. Sound erasure takes place when pressing the editing button first and then Sound Dubbing button while machine is in the Playback mode. .

1-6. INPUT-OUTPUT CONNECTIONS

Figure 1–2 shows all input and output terminals, the input signal requirements, and output-signal characteristics at each point. Normal connections to the Video Monitor are made at the 8-pin jack marked TV. Normal camera connections (SONY CVC- 2100 or CVC-2000) are made at the 6-pin CAMERA connector. Signal and power connections to other accessory equipments are as shown.

A. CAMERA JACK
To connect the SONY Camera CVC-2100 or CVC-2000.

B. MICROPHONE INPUT JACK (MIC. IN)
Signal feed point for SONY microphone or others with similar characteristics.
Signal level requirements : −65 dB, 200~600 ohms, single ended.

C. AUXILIARY INPUT JACK (AUX. IN)
To connect an alternative source of sound, such as a phonograph, tuner, tape recorder or another audio system.
Signal level requirements : −20 dB. This jack is in parallel with pins 7 and 8 of the TV jack.

D. LINE OUT JACK
To permit audio connections to an external Hi-Fi system or a high impedance crystal earphone. Provides an additional audio-output feed to supply

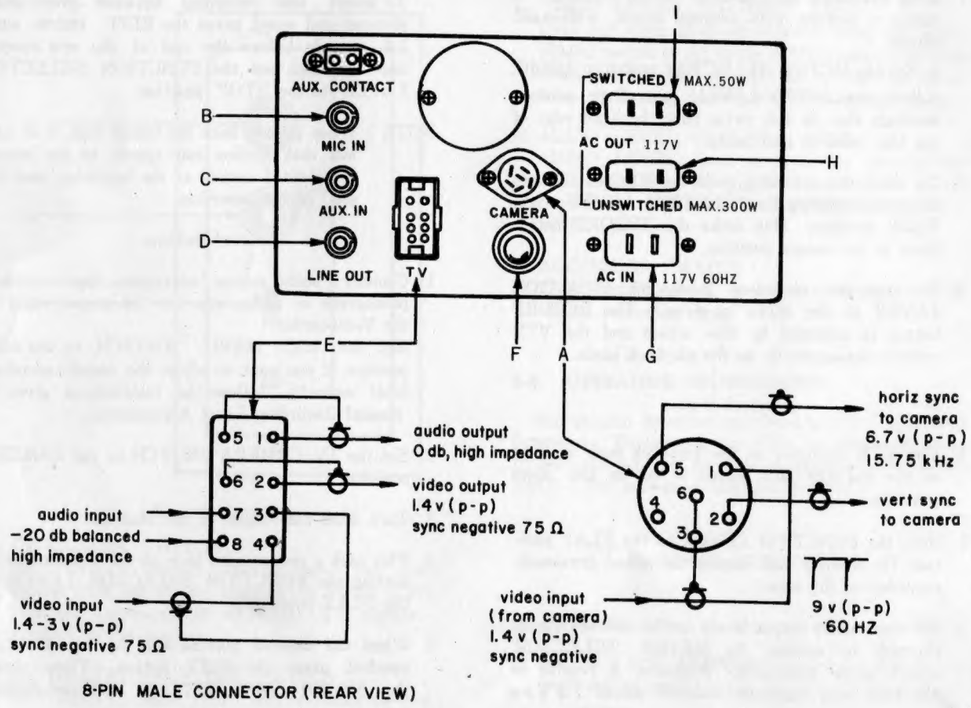

Fig. 1-3. Input-output connections and signal specifications.

playback monitors or other audio systems. Signal level 0 dB (0.775V) across high impedance.

E. TV-MONITOR JACK
To connect SONY monitors or conventional TVsets by means of the SONY TV Adaptor. Video and sound interconnections to peripheral equipment are made at this jack.

F. FUSE HOLDER
Accepts a 1.5A cartridge fuse. Interrupts power input to the VTR and the SWITCHED, MAX. 50W outlet.

G. POWER CORD RECEPTACLE
Power requirements 115-120VAC, 60 Hz, ±0.4 Hz. Power drain 80 watts (VTR only).

H. AC OUTLET (AC. OUT 117V SWITCHED MAX. 50W)
Provides power to the camera CVC-2100 or CVC-2000 Do not plug vacuum-tube type monitors into this outlet.

I. AC OUTLET (AC. OUT 117V UNSWITCHED MAX. 300W)
Provides power to the monitor and any other high power devices.

SECTION 2

TAPE TRANSPORT AND SCAN MECHANISM

2-1. TAPE TRANSPORT

This section describes the mechanism of tape movement in forward, fast forward, and rewind operations. Fundamentals of the slant-track scan system are also shown.

Tape Path

Figure 2–1 shows the path taken by the tape as it moves from the supply reel to the take-up reel. Tape passes the Tension-Brake Tape Guide (B) first. The tension-brake guide senses tape tension and acts to apply braking pressure to the Supply-Reel Table to keep a uniform back tension on the tape. After the Tension-Brake Tape Guide(B), the tape runs past a Tape Guide (C), the full-track erase head (D) and Tape Guide 1 (E). These guides adjust the tape to cross the erase head at the correct height. In addition, Tape Guide 1 alters tape angle slightly so that the tape crosses the Left Tapered Guide (F) at the correct height and angle. The Left Tapered Guide acts to change the direction of the tape; tape angles downward at this point, as it begins its path around the Rotary Head Drum Assembly (G). The tape now runs downward about 180° around the circumference of the Rotary Head Drum Assembly. Since the video heads inside the assembly rotate in a horizontal plane, they trace tracks that slant across the width of the tape. As the tape leaves the Rotary Head Drum assembly at the right side, it is bent back

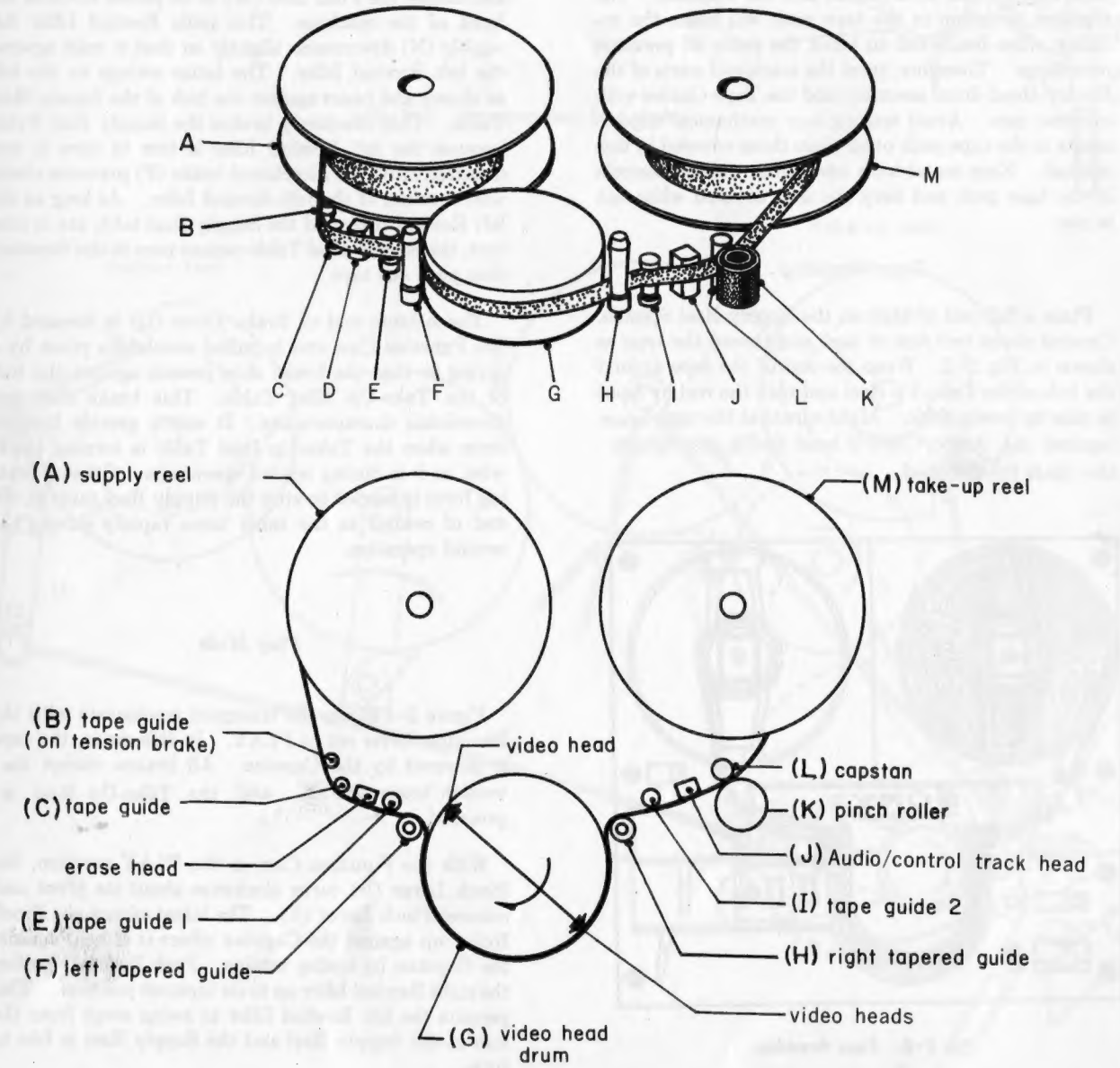

Fig. 2–1. Tape path.

to the horizontal by the Right Tapered Guide (H). Tape then passes the Automatic Shutoff sensor and Tape Guide 2 (I). If tape should run out, the Automatic Shutoff sensor moves towards the front of the machine and actuates a microswitch that interrupts A-C input power. Following Tape Guide 2 (I), the tape bears against the Audio/Control track heads (J). Here the audio track is recorded on the upper edge of the tape and control pulses are recorded on the lower edge. These control-track pulses provide the timing reference for the servo system during playback.

Finally, the tape is squeezed between the Capstan (L) and the Pinch Roller (K), and fed to the Take-Up Reel (M). The latter is powered through a friction-clutch arrangement which maintains a uniform tension on the tape as it leaves the capstan.

WARNING

The tape is guided with very great precision along its path between the Erase Head and the Capstan. The slightest deviation in the tape path will make the rotating video heads fail to track the paths of previous recordings. Therefore, treat the machined parts of the Rotary-Head drum assembly and the Tape Guides with extreme care. Avoid making any mechanical adjustments in the tape path other than those covered in this manual. Keep metal tools away from the components in the tape path and keep the unit covered when not in use.

Tape Threading

Place a full reel of tape on the Supply Reel Spindle. Unwind about two feet of tape and thread the tape as shown in Fig. 2-2. Wrap the end of the tape around the hub of the Take-Up Reel and turn the reel by hand to take up excess slack. Make sure that the tape bears against the Audio/Control head and is not outside the plate for the head.

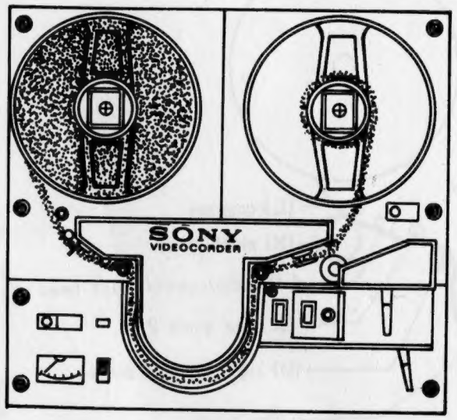

Fig. 2-2. Tape threading.

STOP Mode

Figure 2-3 shows a simplified diagram of the tape-transport mechanism as it appears when the Function Lever is set to STOP. In this mode, both tape reels are braked, and the Pinch Roller is pulled back from the Capstan.

Details are as follows. The Function Lever and the Function Cam (C) are shown in the stop position. Pinch Lever B is rotated counterclockwise about its pivot as shown by the small arrows. The pawl of Pinch Lever B presses against Pinch Lever A to move the pinch roller (F) away from the capstan. Pinch Lever B also rotates the Tension Brake Control Lever (G) about its pivot so that the Tension-Brake-Off Rod (H) is pulled to the right. This rotates the Control Lever and the brake shoe (K) is pulled back from the Supply Reel Table (L).

The STOP position of the Function Selector Cam also causes the Push Rod (M) to be pulled towards the front of the machine. This pulls Rewind Idler Assembly (N) downwards slightly so that it rolls against the left Rewind Idler. The latter swings to the left as shown and bears against the hub of the Supply Reel Table. This effectively brakes the Supply Reel Table because the left Rewind Idler is free to turn in one direction only. A directional brake (P) prevents clockwise rotation of the left Rewind Idler. As long as the left Rewind Idler and the Supply Reel table are in contact, the Supply-Reel Table cannot turn in the direction that pays out tape.

The bottom end of Brake Lever (Q) is released by the Function Cam and is pulled around its pivot by a spring so that the brake shoe presses against the hub of the Take-Up Reel Table. This brake shoe has directional characteristics. It exerts greater braking force when the Take-Up Reel Table is turning clockwise, as it is during rewind operations. Greater braking force is needed to stop the Supply Reel table at the end of rewind as the table turns rapidly during the rewind operation.

Play Mode

Figure 2-4 shows the transport mechanism with the Function Lever set to PLAY. In this mode, the tape is powered by the Capstan. All brakes except the tension brake are off, and the Take-Up Reel is powered.

With the Function Cam in the PLAY position, the Pinch Lever (B) turns clockwise about its pivot and releases Pinch Lever (A). The latter swings the Pinch Roller up against the Capstan where it is held against the Capstan by spring tension. Push Rod (M) pushes the right Rewind Idler up to its topmost position. This permits the left Rewind Idler to swing away from the hub of the Supply Reel and the Supply Reel is free to turn.

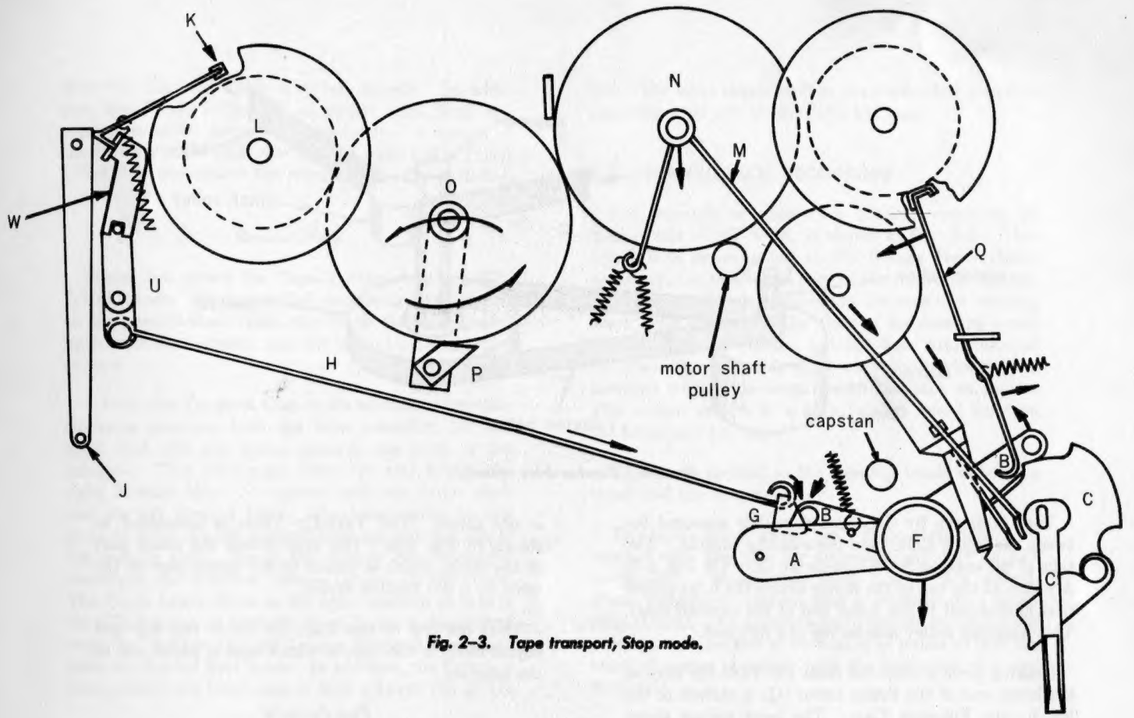

Fig. 2-3. Tape transport, Stop mode.

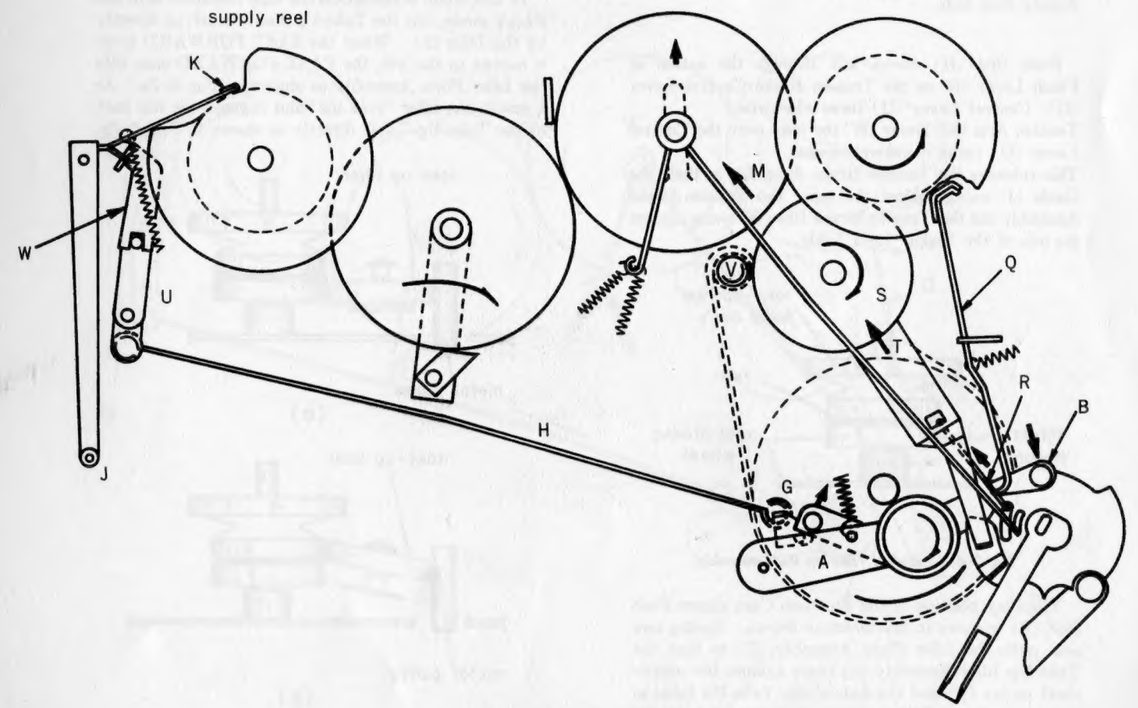

Fig. 2-4. Tape transport, Play mode.

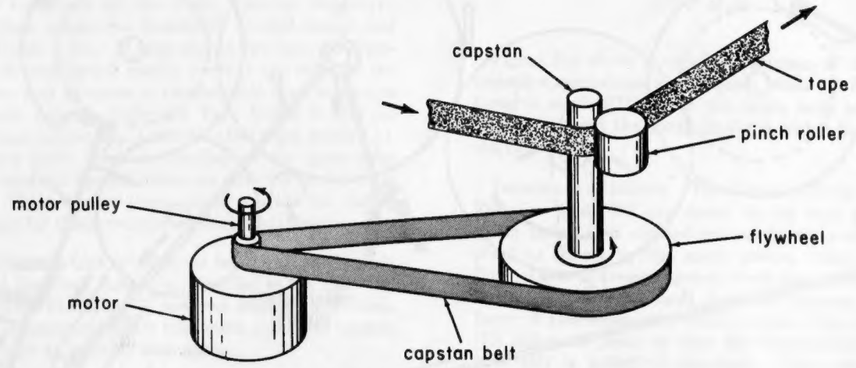

Fig. 2-5. Capstan drive system.

Tape is driven by the capstan as it is squeezed between the Pinch Roller and the rotating capstan. Details of the capstan drive system are shown in Fig. 2–5. A pulley at the top of the motor drives the large pulley that is attached to the lower end of the capstan shaft. This weighted pulley also serves as a flywheel.

Braking force is removed from the Take-Up Reel as the lower end of the Brake Lever (Q) is shifted to the left by the Function Cam. The lever swings about its pivot and the brake shoe moves away from the Supply-Reel hub.

Push Rod (H) moves left through the action of Pinch Lever (B) on the Tension Brake Control Lever (G). Control Lever (U) turns clockwise.
Tension Arm Off Lever (W) the yoke over the Control Lever (U) turns counterclockwise.
This releases the Tension Brake Assembly so that the Guide (J) swing against the tape, and Tension Brake Assembly and the Tension Brake Shoe (K) swing against the hub of the Supply Reel Table.

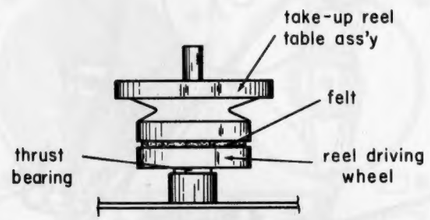

Fig. 2–6. Detail of Take-Up Reel assembly.

The Play position of the Function Cam allows Push Rod (R) to move in the direction shown. Spring tension pulls the Idler Plate Assembly (T) so that the Take-Up Idler Assembly (S) bears against the motor-shaft pulley (V) and the hub of the Take-Up table at the same time. Thus, torque is transferred to the Take-Up Reel. However, drive to the Take-Up Table is not direct. The Take-Up Table is assembled as shown in Fig. 2–6. The idler drives the lower part of the table, which is joined to the upper part of the table by a felt friction clutch.

Thus the top of the Take-Up Table can slip and adjust itself to the rate at which tape is payed out at the capstan.

Fast Forward

In this mode of operation the tape transport is in the PLAY mode, but the Take-Up Table is driven directly by the Idler (S). When the FAST FORWARD lever is moved to the left, the FAST FORWARD cam tilts the Idler Plate Assembly as shown in Fig. 2–7a. As a result, the idler "runs up" and engages the top part of the Take-Up Table directly as shown in Fig. 2–7b.

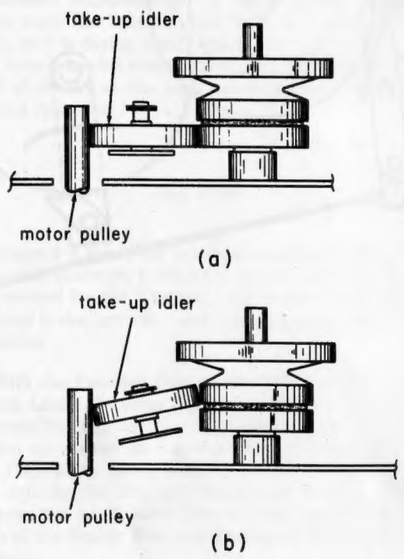

Fig. 2–7. Detail of Fast-Forward drive system.

Now the Take-Up Table is driven directly. In addition the Pinch Roller (F) is pulled back from the capstan to allow the tape to pass freely. A section of the FAST FORWARD cam lifts the right end of Pinch Lever B to accomplish the release of the Pinch Roller.

Rewind Mode

Figure 2–8 shows the Tape Transport in the REWIND mode. During rewind, reverse drive is applied to the Supply-Reel Table, the Pinch Roller is pulled back from the Capstan, and the Take-Up Table is free to turn.

With the Function Cam in its maximum counterclockwise position, both the Idler assembly (S) and Push Rod (M) are pulled towards the front of the machine. This disengages Idler (S) and brings the right Rewind Idler (N) against both the motor shaft and the left Rewind Idler. The latter shifts its axis so as to press the left Rewind Idler against the hub of the Supply Reel. Hence the Supply Reel is driven directly in the direction (reverse) shown by the arrow. The Pinch Lever (B) is in the same position as it is in the STOP mode, so that the Pinch Roller is disengaged from the Capstan and the Tension Brake is disengaged from the Supply Reel Table. In addition, the Function Cam pushes the lower end of Brake Lever (Q) to the left. The lever pivots so that the brake shoe is pulled away from the hub of the Take-Up Reel.

2-2. SLANT-TRACK RECORDING

The principle of slant-track (helical) scanning, as used in the SONY VTR, is shown in Fig. 2–9. This principle is implemented in the Rotary Head Drum Assembly, the most vital part of the recording system. Two magnetic heads, mounted at the ends of a rotating beam, scan the tape. The plane of the rotating heads is parallel to the chassis, but the tape wraps around the head-drum assembly at an angle to the chassis. A recorded track thus slants across the tape as shown. This system results in a high relative speed between the heads and the tape.

Signals are applied to the rotating heads through a brush and slip ring assembly.

The heads rotate at 30 rps. Since each head is in contact with the tape for approximately 180° (a half revolution), a single scan takes 1/60th of a second. Thus, a complete vertical field is recorded on a single scan (track). An accurate servo system controls head rotation with respect to vertical sync pulses so that the start of a scan coincides with the beginning of a vertical field.

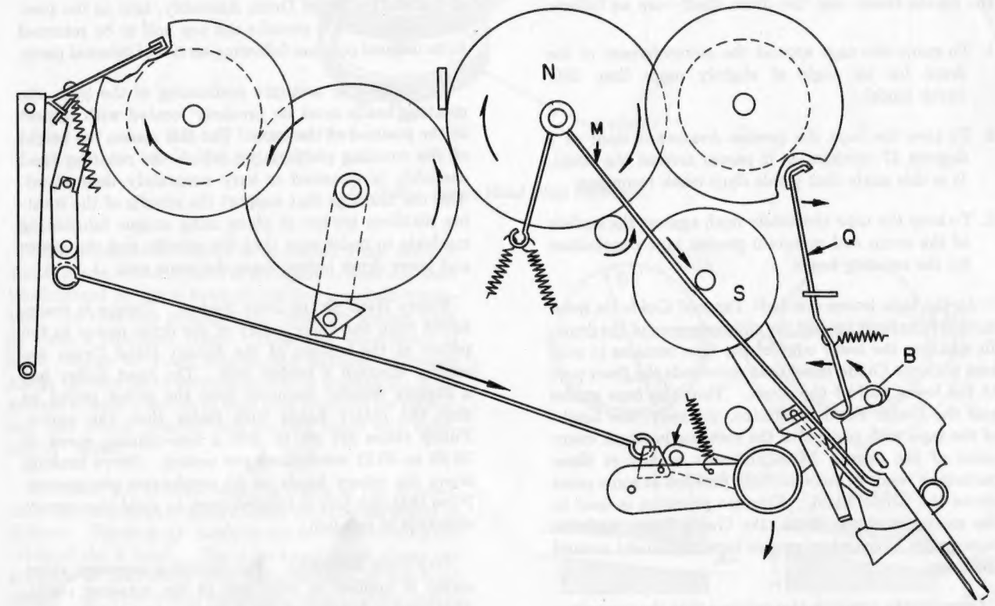

Fig. 2–8. Tape transport, Rewind mode.

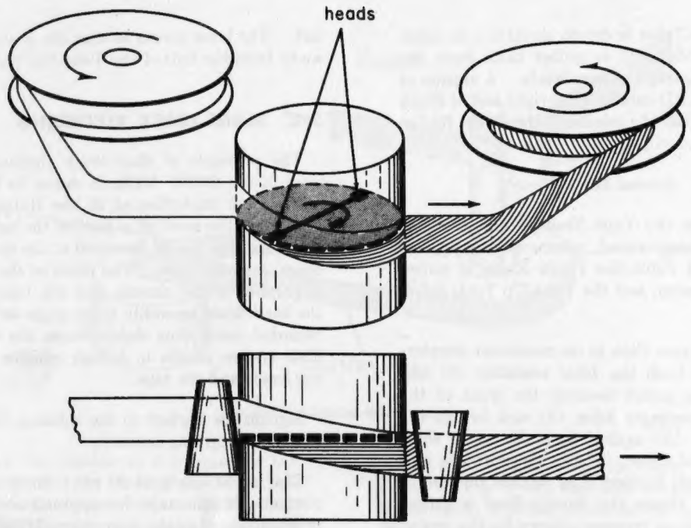

Fig. 2–9. Helical or Slant-track recording system, simplified.

2-3. ROTARY HEAD DRUM ASSEMBLY

Figure 2–10 shows the mechanical components of the Rotary Head Drum Assembly. The purposes of the stationary components—the tape and tapered guides, the Guide Band, and the drum itself—are as follows.

1. To guide the tape around the circumference of the drum for an angle of slightly more than 180° (wrap angle).

2. To give the tape the precise downward slant of 2 degrees 47 minutes as it passes around the drum. It is this angle that yields slant-track recording.

3. To keep the tape absolutely flush against the surface of the drum and maintain precise tape penetration by the rotating heads.

As the tape leaves the Left Tapered Guide its inner surface runs flush against the circumference of the drum. In addition the lower edge of the tape remains in contact with the Guide Band that surrounds the front part of the lower half of the drum. Thus the tape guides and the Guide Band determine, precisely, the height of the tape with respect to the rotating heads at every point of the drum. Misadjustment of any of these parts may result in incorrect tape position at some point above the Guide Band. Extreme precision is used in the assembly of the drum, the Guide Band, and the tape guides to maintain proper tape movement around the drum.

Correct tape tracking also requires that the upper and lower halves of the drum be absolutely parallel and concentric with the shaft of the rotating heads. This requires very precise machining and polishing of drum surfaces and accurate positioning of the top half of the drum with respect to the bottom. Since the top half of the drum is made removable for service, provision is made to reinstall the top half in its original position. A carefully positioned Locating (butt) Plate, at the rear of the Rotary Head Drum Assembly, acts as the position reference. It permits the top half to be returned to its original position following service of internal parts.

In addition to accurate positioning of the tape, the rotating heads must be precisely located with respect to the position of the tape. For this reason the height of the rotating platform on which the rotating head assembly is mounted is very accurately determined. Also the bearings that support the spindle of the rotating platform are set in place using unique fabricating methods to make sure that the spindle and the upper and lower drum halves share the same axis.

Rotary Head Drum Drive System. Torque is transferred from the lower pulley of the drive motor to the pulley at the bottom of the Rotary Head Drum Assembly through a rubber belt. The head pulley has a slightly smaller diameter than the motor pulley so that the rotary heads turn faster than the motor. Pulley ratios are set to give a free-running speed of 30.28 to 30.31 revolutions per second. Servo braking slows the rotary heads to 30 revolutions per second. Note that the belt is twisted once to yield the correct direction of rotation.

Skip-Field Recording. For recording purposes, video signal is applied to only one of the rotating heads. This head is designated the *A* head. As a result, alternate fields are not recorded. The skipped fields are those that occur during the half revolution when the A head is not in contact with the tape.

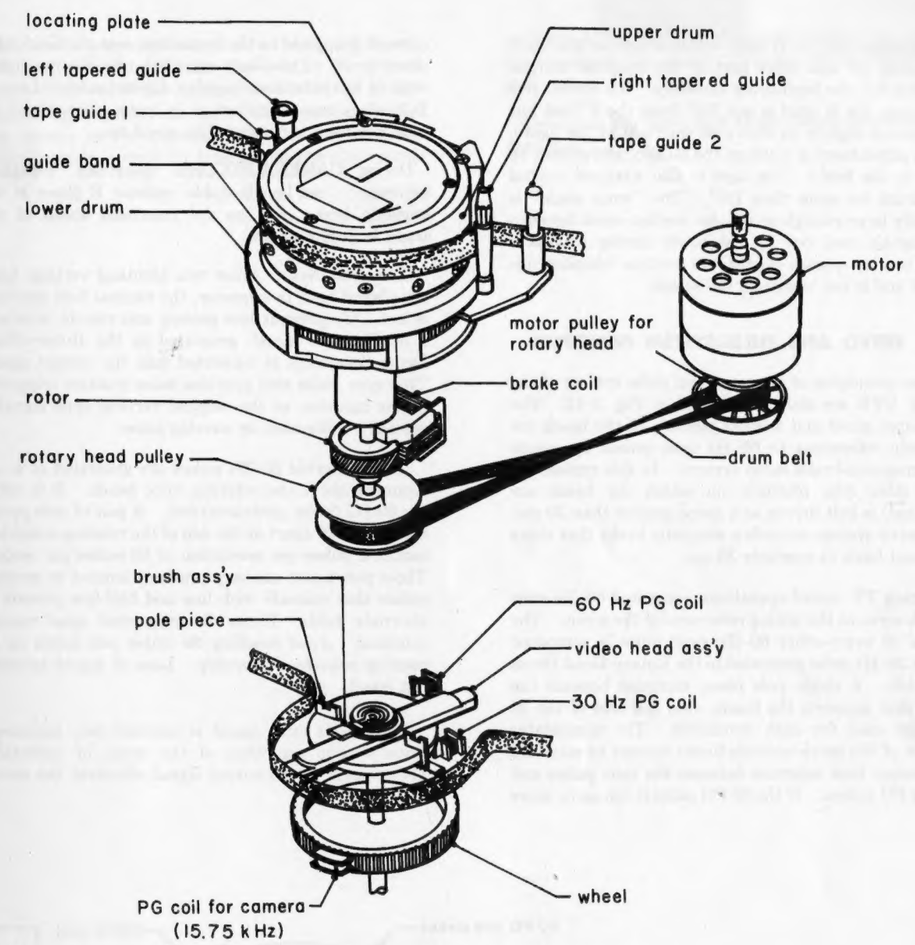

Fig. 2-10. Rotary Head Drum Assembly.

During playback, signal is extracted from both A and B heads. The B head is arranged to scan the same track traced by the A head on the previous half revolution. In this way two identical fields are played back to form a complete frame. However, since there is little change in video information between alternate fields, the change in picture quality is negligible. This system affords a saving in tape area required for recording, and makes possible long playing times with existing ½" tapes.

To make the B head scan the track of the A head, the relative positions of the heads must be arranged as follows. Figure 2–11 shows a solid line representing the track of the A head. The right hand figure shows the position of that track after ½ revolution of the head assembly. Tape travel causes the track to move downwards by the distance H. Thus the B head must rotate in a horizontal plane that is below that of the A head. In addition, the beginning of the track moves the distance *d* in the time taken for ½ revolution.

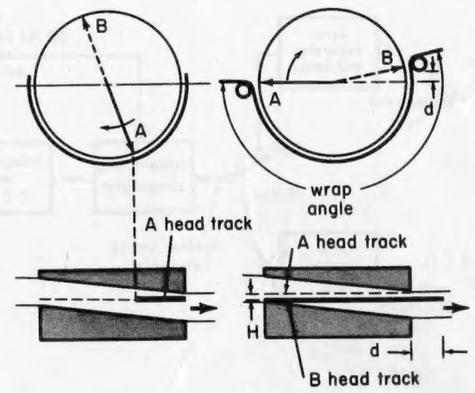

Fig. 2–11. Principle of Skip-Field recording and playback.

This means that the B head will miss part of the track and begin its scan after part of the recorded vertical field has left the head-drum assembly. To correct this condition, the B head is not 180° from the A head but is retarded slightly as shown at the right of the figure. (This adjustment is made at the factory and cannot be reset in the field.) The tape is also wrapped around the drum for more than 180°. The "wrap angle" is actually large enough so that an *overlap* exists between the signals read out by the heads during playback. This overlap occurs during the vertical blanking interval and is not visible on the screen.

2-4. SERVO AND PULSE-SYSTEM PRINCIPLES

Basic principles of the servo and pulse system of the SONY VTR are shown simplified in Fig. 2-12. The rotational speed and angular position of the heads are precisely referenced to 60-Hz sync pulses by means of a magnetic-brake servo system. In this system the head table (the platform on which the heads are mounted) is belt driven at a speed greater than 30 rps. The servo system controls a magnetic brake that slows the head table to precisely 30 rps.

During TV record operations, separated 60-Hz sync signals serve as the timing reference for the servo. The arrival of every-other 60-Hz sync pulse is compared with a 30-Hz pulse generated in the Rotary-Head Drum assembly. A single pole piece, mounted beneath the table that supports the heads, cuts the field of the 30 PG coil once for each revolution. The comparator system of the servo controls brake current to maintain the correct time reference between the sync pulses and the 30 PG pulses. If the 30 PG pulse is too early, more current is applied to the brake coil and the head table slows down. Drive-belt elasticity absorbs the difference in instantaneous angular displacement. Late 30 PG pulses cause a reduction in brake current and the head platform is permitted to speed up.

During CAMERA-RECORD operations constant-current, set by adjustable resistor R flows in the magnetic brake coil, so the rotational speed of the heads is held constant.

Reinserted Sync. Since two identical vertical fields are played back in sequence, the natural field interlace is lost. To prevent line pairing and restore interlace, a 60-Hz sync signal, generated in the Rotary-Head Drum Assembly, is reinserted into the output signal. This sync pulse also provides more positive triggering in the monitor, as the original vertical sync signal is partially obliterated by overlap noise.

The reinserted 60-Hz pulses are generated in a coil mounted above the rotating video heads. It is called the 60 PG (pulse generator) coil. A pair of pole pieces, mounted 180° apart on the top of the rotating assembly, induce 2 pulses per revolution or 60 pulses per second. These pole pieces are very precisely located to produce pulses that coincide with line and half-line periods on alternate fields. Hence the reinserted sync restores interlace. *Avoid handling the upper pole pieces on the rotating video-head assembly.* Loss of signal interlace can result.

The 60-Hz sync signal is inserted into composite video output regardless of the mode of operation. They appear in the output signal whenever the motor is running.

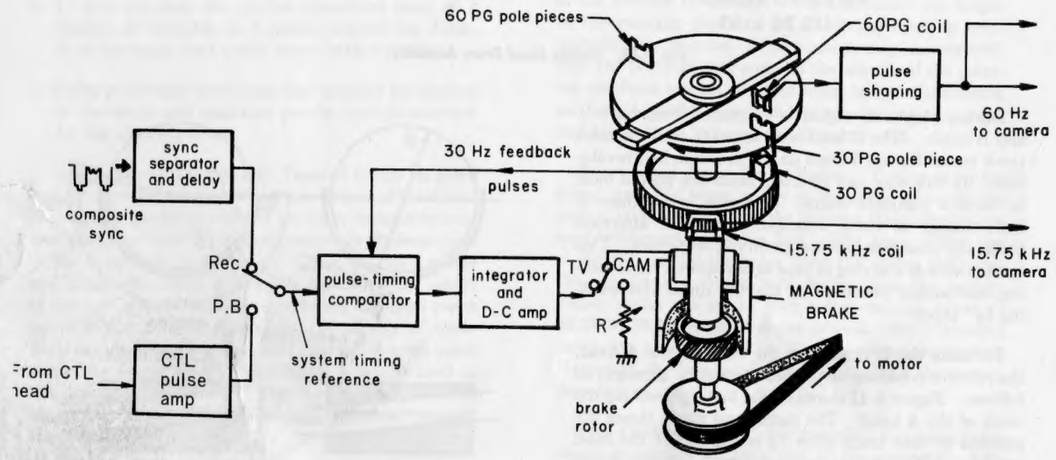

Fig. 2-12. Servo system principle.

The 60 PG pulse is also routed to the camera to synchronize the 60-Hz deflection oscillator in the camera. In addition, 15, 750-Hz pulses generated in the Rotary Head Drum assembly are fed to the horizontal deflection system in the camera. These accurately-timed pulses provide correct 2:1 interlace in the video signal produced by the camera. However, when the motor is not running, the camera reverts to random-interlace operation.

Details of the Servo and Pulse system are found in Section 3.